

PHGenFit: Interface to GenFit for easy use

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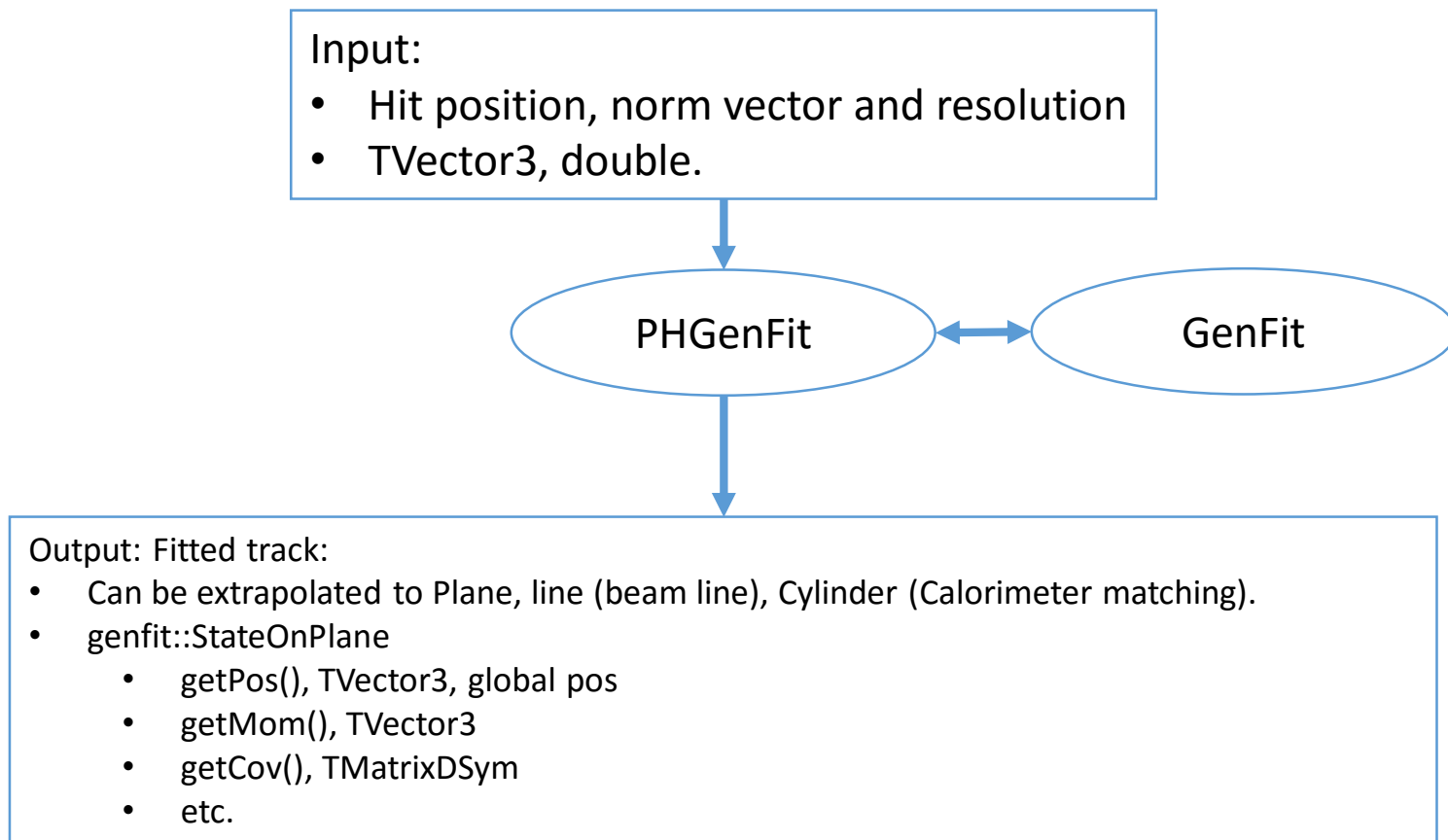
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PHGenFit

- Motivation: simplify the use of GenFit.
- The design is independent of detector types.

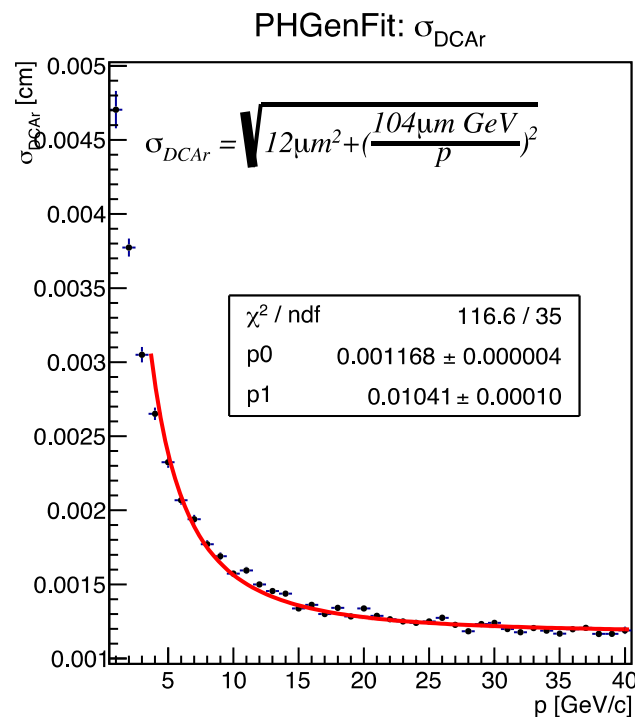
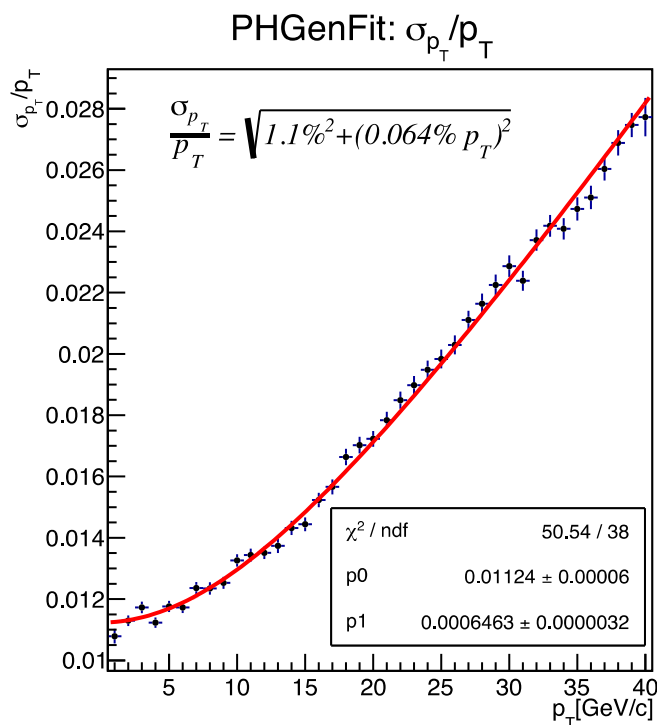


Structure

- PHGenFitPkg (folder, package root)
 - GenFitExp (folder, contains classes in “genfit” namespace)
 - Field (folder)
 - Field2D (class, in namespace of “genfit”)
 - G4eTrackRep (folder, place holder for the future.)
 - PHGenFit (folder, namespace)
 - Fitter (fitter class, contains geometry, field setup, fitter choice, etc.)
 - Measurement (input class)
 - PlanarMeasurement (TVector3 pos(), TVectro3 norm(), double du, double dv)
 - SpacePointMeasurement
 - etc.
 - Track (output class)
 - extrapolateToPlane()
 - extrapolateToLine()
 - extrapolateToCylinder()
 - extrapolateToPoint()

Current status:

- In my fork of the sPHENIX coresoftware, under offline/packages/PHGenFitPkg:
- <https://github.com/HaiwangYu/coresoftware/tree/master/offline/packages/PHGenFitPkg>
- Status: Functional, can re-produce the the pT and the DCAr resolution plots showed in last software meeting.



```

45  //!< Initialize Geometry, Field, Fitter
46  PHGenFit::Fitter* fitter = new PHGenFit::Fitter("sPHENIX_Geo.root","sPHENIX.2d.root", 1.4 / 1.5,"KalmanFitter");
47
48  //!< Build TrackRep from particle assumption
49  int pid = -13; //mu+
50  genfit::AbsTrackRep* rep = new genfit::RKTrackRep(pid);
51
52  //!< Initialize track with seed from pattern recognition
53  TVector3 seed_pos;
54  TVector3 seed_mom;
55  TMatrixDSym seed_cov;
56  get_seed(seed_pos,seed_mom, seed_cov);
57  PHGenFit::Track* track = new PHGenFit::Track(rep, seed_pos,seed_mom, seed_cov);
58
59  //!< Create measurements
60  std::vector<TVector3> v_pos = get_raw_measurements();
61  double res_phi = 0.005; //cm
62  double res_z = 0.04; //cm
63  std::vector<PHGenFit::Measurement*> measurements;
64  for (unsigned int imeasurement = 0; imeasurement < v_pos.size(); imeasurement++) {
65      TVector3 pos = v_pos[imeasurement];
66      TVector3 n(pos.X(),pos.Y(),0);
67      PHGenFit::Measurement* meas = new PHGenFit::PlanarMeasurement(pos,n,res_phi, res_z);
68      meas->getMeasurement()->Print();
69      measurements.push_back(meas);
70  }
71
72  //!< Add measurements to track
73  track->addMeasurements(measurements);
74
75  //!< Fit the track
76  fitter->processTrack(track, true);
77
78  //!< Extrapolate to beam line
79  genfit::StateOnPlane* state_at_beam_line = track->extrapolateToLine(TVector3(0, 0, 0), TVector3(0, 0, 1));
80  state_at_beam_line->Print();
81
82  //!< Event display
83  fitter->displayEvent();

```

Initialize track with seed

Add measurements

Fit

Various ways of looking at the fitting result

Summary

Progress:

- PHGenFit is a thin layer between sPHENIX and GenFit, targeting minimize the code needed for using GenFit.
- Subsystem independent input design, basically taking “TVector3”s as the input.
- Currently functional but very rough.

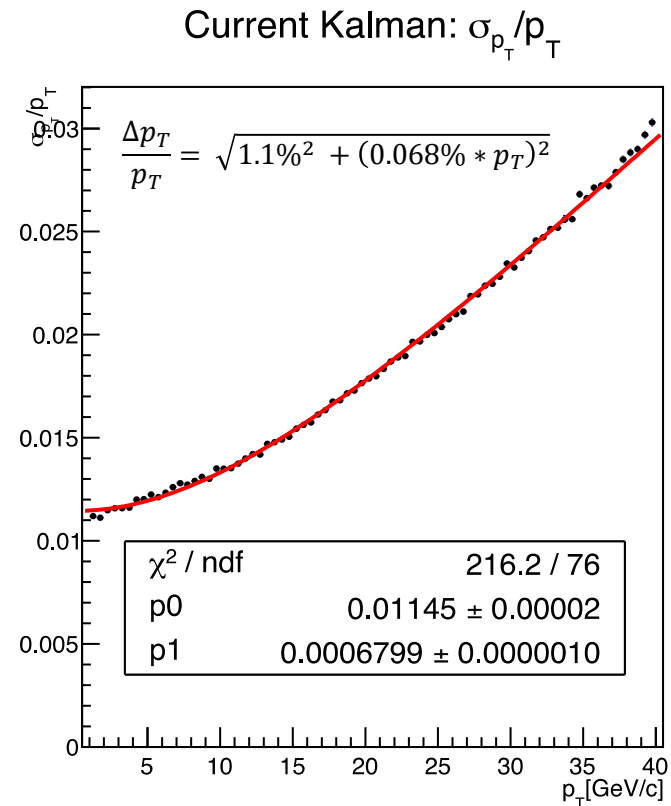
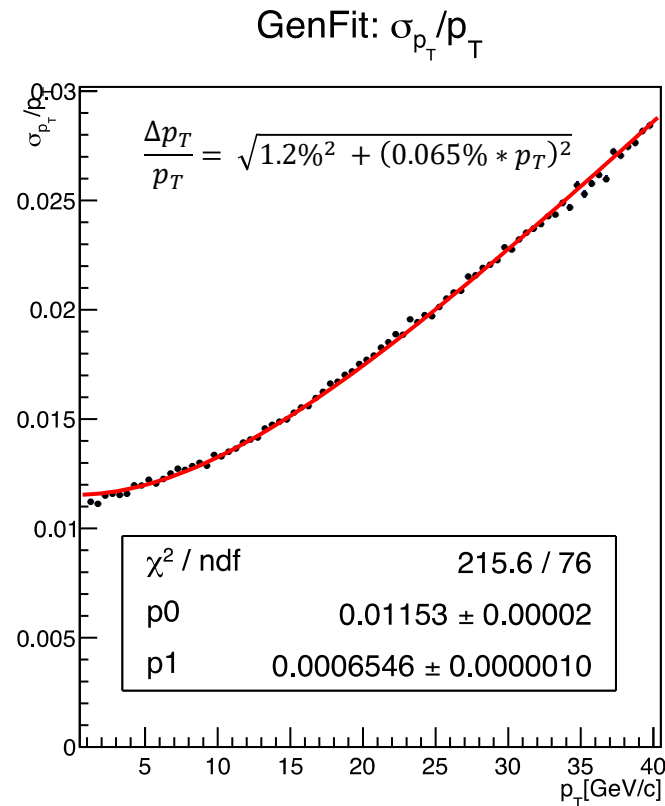
Next step:

- On-the-fly G4Geo -> TGeo translation.
- Integrate with sPHENIX Hough, eg. outlier handling.
- Test in real sPHENIX.
- RAVE (work with Sanghoon)

Comments and suggestions are very appreciated.

Backups

pT resolution: GenFit vs Current Kalman



p0 term is 0.8% (relative) larger than Current Kalman
p1 term is 3.7% (relative) smaller than Current Kalman,

pT resolution: cont'd

sPHENIX pre-Conceptual Design Report, Oct, 2015

<https://indico.bnl.gov/getFile.py/access?resId=0&materialId=11&confId=1483>

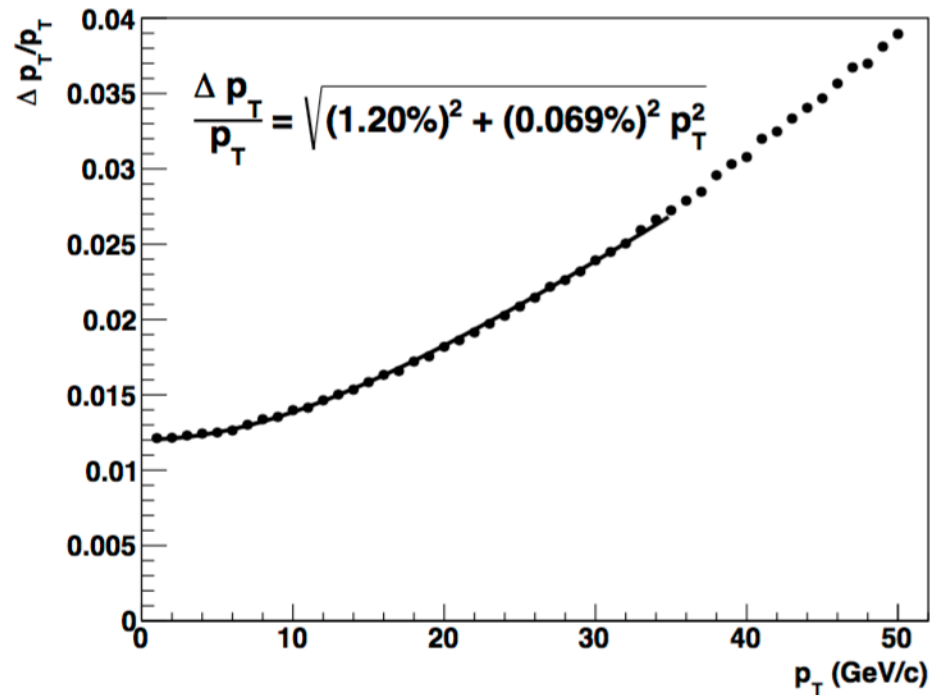
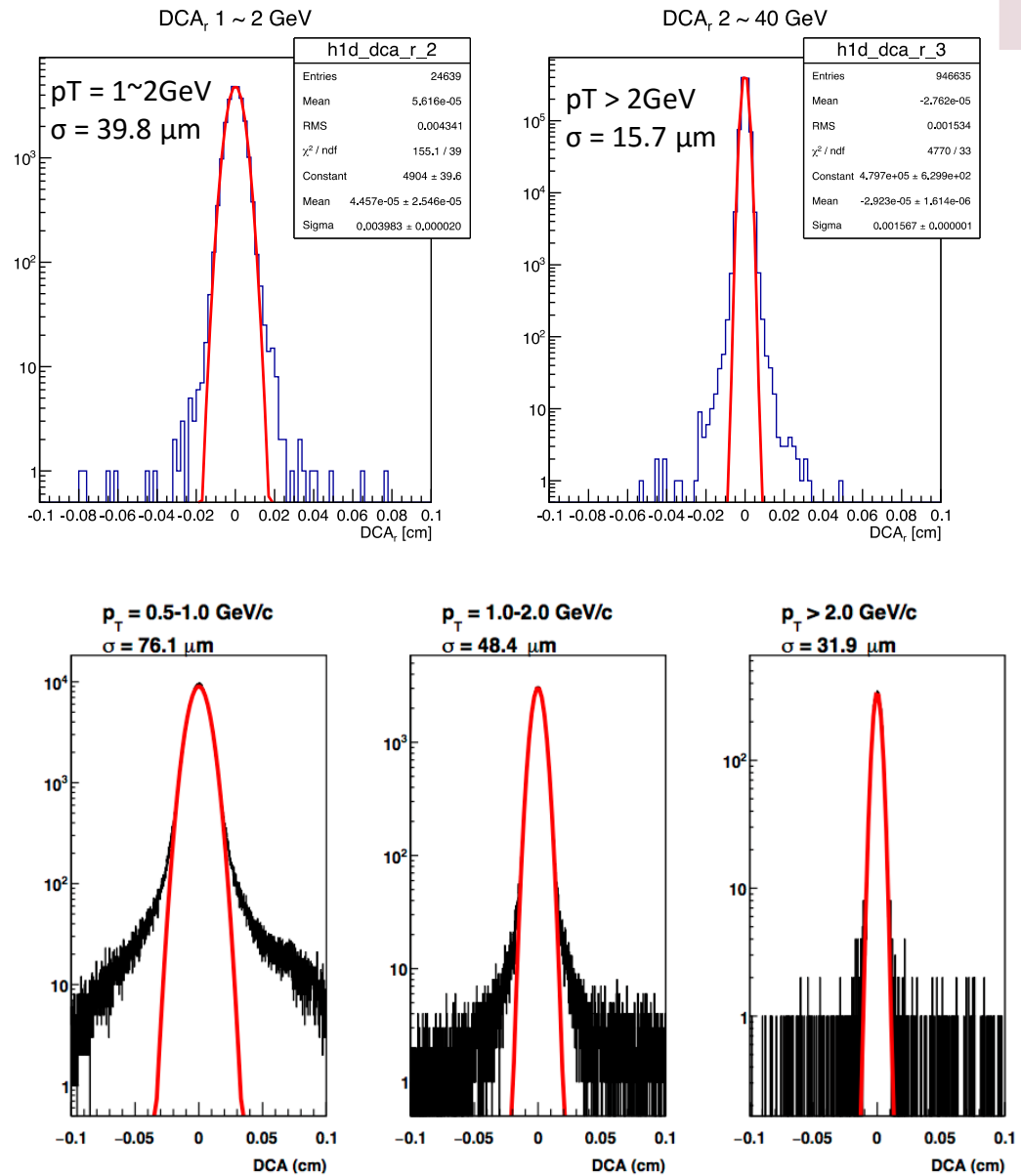


Figure 4.11: Momentum resolution of the silicon tracker for single pions.

- Track DCAr resolution without vertex smearing using GenFit.
- This result is a last minute result. So very preliminary.



- DCAr resolution with vertex smearing in sPHENIX PCDR. So not ready for comparison yet.
- Mike is working on DCAr resolution without vertex smearing for comparison.

Figure 4.5: The DCA resolution of the silicon tracker in three track momentum ranges, from tracks reconstructed in central HIJING events.